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JC10 Rec'd PCT/PTO 18 JAN 2002

PCT

20/18/02 JC46 U.S. PTO

FORM PTO-1390 (REV. 12-2001)	U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		1999P2311US
		U.S. APPLICATION NO (If known, see 37 CFR 1.5) 10/031666
INTERNATIONAL APPLICATION NO. PCT/DE00/02324	INTERNATIONAL FILING DATE 18July2000	PRIORITY DATE CLAIMED 19July1999

TITLE OF INVENTION Optical-Fiber Connector and Method of Connection to the End of an Optical-Fiber-Cable

APPLICANT(S) FOR DO/EO/US CCS Technology, Inc.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [X] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [ ] Other items or information:

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U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/031666	PCT/DE00/02324	1999P2311US

21. ☒ The following fees are submitted.

	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	4 - 20 =	0	x **$18.00**	$
Independent claims	2 - 3 =	0	x **$84.00**	$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$
TOTAL OF ABOVE CALCULATIONS =				$ 890.00
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$
SUBTOTAL =				$ 890.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$
TOTAL NATIONAL FEE =				$ 890.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$
TOTAL FEES ENCLOSED =				$ 890.00
			Amount to be refunded:	$
			charged:	$ 890.00

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 19-2167 in the amount of $ 890.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-2167. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Michael L. Leetzow
800 17th Street NW
PO Box 489
Hickory, NC 28603

SIGNATURE

Michael L. Leetzow
NAME

35,932
REGISTRATION NUMBER

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: BOX PATENT APPLICATION, COMMISSIONER OF PATENTS, WASHINGTON, D C 20231 on 1/18/02, 2002

Patricia L. Mesuch — Date of Signature 1/18/02

PATENT
Attorney Docket No. 1999P2311

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
Rainer Zimmer et al.	)	
Serial No.: Unassigned	)	Group Art Unit: Unassigned
Filed: Concurrent Herewith	)	Examiner: Unassigned

For: Optical-Fiber Connector and Method of Connection to the End of Optical-Fiber-Cable

PRELIMINARY AMENDMENT

BOX PATENT APPLICATION
COMMISSIONER OF PATENTS
WASHINGTON, D. C. 20231

Dear Sir:

Prior to examination of the above-identified United States National Stage patent application, please amend the application as follows:

IN THE CLAIMS:

Please delete claims 1-5 without prejudice and insert claims 6-9 therefore.

--6. An optical fiber connector attachable to a fiber optic cable, the optical fiber connector having a factory polished end face and comprising:

a ferrule having a piece of an optical fiber previously secured therein, the piece of optical fiber extending from the ferrule in a rearward direction for fusion splicing to the fiber optic cable;

a ferrule holder removably attached to the ferrule to allow the piece of optical fiber

extending from the ferrule to be exposed and fusion spliced to the fiber optic cable;

a basic housing to fit over the ferrule and ferrule holder;

a crimping ring for fixing a stress member of the fiber optic cable to the basic housing;

an anti-kink guard that slides over the fiber optic cable and attaches to an end of the basic housing; and

an outer housing.

7. The optical fiber connector of claim 6, wherein the piece of the optical fiber extending from the ferrule has an end point that is disposed within the ferrule holder when the ferrule holder is attached to the ferrule.

8. A method of connecting an optical fiber connector to an fiber optic cable comprising the steps of:

providing a ferrule having a piece of an optical fiber previously secured therein, the piece of optical fiber extending from the ferrule in a rearward direction;

sliding a ferrule holder over a portion of the fiber optic cable, the ferrule holder being removably attachable to the ferrule;

fusion splicing the piece of optical fiber extending outward from the rearward portion of the ferrule to an optical fiber in the fiber optic cable; and

inserting the ferrule into the ferrule holder, the ferrule holder housing a portion of the piece of optical fiber and a portion of the optical fiber in the fiber optic cable after the piece of optical fiber and the optical fiber are fused together.

9. The method of claim 8, further comprising the steps of:

inserting the ferrule and ferrule holder into a basic housing;

crimping a crimp ring to the basic housing to secure at least one stress member from the

fiber optic cable to the basic housing;

securing an anti-kink guard to a rearward end of the basic housing; and

sliding an outer housing over at least a portion of the basic housing.--

IN THE SPECIFICATION:

Please replace the original specification with the substitute specification submitted herewith. Pursuant to 37 C.F.R. §1.121(b)(3), Applicants have provided a marked-up version and a clean version of the specification. No new matter has been added to the specification. Applicants have amended the specification to comply with US practice and correct some translated terms. Applicants have also added an abstract.

REMARKS

Applicants have cancelled the previously pending claims and have submitted claims that are more appropriate to US practice. Applicants do not believe that the claims have been narrowed and therefore assert that the ruling in Festo, if applicable to applications filed under 35 USC §371, would not apply. Applicants have also attached the changes made to the specification as required by 37 C.F.R. §1.121(b).

If there are any fees not accounted for, the Commissioner is authorized to charge those fees to Deposit Account No. 19-2167.

Respectfully submitted,

Date: 1/18/02

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Optical-Fiber Connector and Method of Connection to the End of an Optical-Fiber-Cable

The invention relates to an optical fiber connector having an optical fiber piece fixed in the factory in a ferrule, the end of the optical fiber directed outward being provided with a polished surface, and the end directed inward projecting from the ferrule and being connected by thermal welding to the inserted end of an optical fiber to be connected, the ferrule further being fixed in a ferrule holder.

Furthermore, the invention relates to a method for connecting this optical fiber connector to the end of an optical fiber cable.

BACKGROUND OF THE INVENTION

Two groups of connectors, factory-fitted and field-mounting connectors, are known per se. Very good mechanical and optical properties can be achieved with factory-fitted connectors. It is thereby possible to assemble all types of fibers onto the corresponding connectors. The end faces of the connectors can be provided according to the requirements with all known sections such as, for example, 0°PC, APC or UPC. However, it is disadvantageous in this case that this type of connector must be provided with a piece of glass fiber (pigtail) whose length is mostly between 2.5 and 3 meters. The end of this glass fiber piece is then spliced onto the cable to be connected. However, this produces an additional connection, or splice point, which brings with it an additional loss in the transmission link. This connecting point must then additionally be surrounded by an appropriate mechanical guard.

In the case of "field-mounting connectors", it is advantageous that the cable to be connected can be connected directly to the connector. This eliminates the additional splice, and also the additional mechanical guard. A plurality of systems of field-mounting connectors are known. In the case of a bonded connector, the optical fiber is bonded in an appropriate receptacle and the end face is subsequently ground and polished. However, with some types of section this grinding and polishing operation is very difficult, or even cannot be executed at all. In the case of what are termed spliced connectors, a synthesis of factory-fitted and field-mounting connectors is undertaken. With these connectors, the difficult part of

bonding in the optical fibers, and the grinding of the end face are already carried out in the factory, and the connection, or splicing on of the optical fiber to be connected is then executed on site during the actual field assembly. In principle, this type of connector corresponds to a factory-fitted connector, but no additional outlay is required here to protect the splice point, because the splice is located directly in the connector. Such a type of connector is known by the name of "FuseLite connector". In the case of such a "FuseLite connector", use is made of a factory-fitted ferrule with a bonded optical fiber that is ground at the end face and in the case of which an optical fiber piece projects toward the second end face. The optical fiber to be connected is mounted directly onto this optical fiber piece by thermal splicing inside the connector housing. This means that in this region the connector must have appropriate cutouts through which the arc must be guided for welding. This means that in this region the connector must consist of a material of high quality that is exceptionally heat resistant. This material is not permitted to warp at the existing high temperatures, since otherwise it is impossible to achieve the required splice quality. A high quality ceramic, for example zirconium, is used as material for this purpose.

German laid-open application DE 19517750 discloses an optical fiber connector in the case of which the end of an already permanently fixed piece of optical fiber is connected by thermal welding in a connecting sleeve to the end of an optical conductor to be connected. Recessed into the connecting sleeve for this purpose are lateral openings through which the welding electrodes are led up to the splice point.

SUMMARY OF THE INVENTION

It is the object of the present invention to create a field mounting optical fiber connector in the case of which the above-named difficulties relating to splicing are simplified, and in the case of which it is also possible to make use in the splice region of materials not of such high quality. The object set is achieved with the aid of an optical fiber connector of the type explained at the beginning, by virtue of the fact that the ferrule with the fixed optical fiber can be detached from the ferrule holder before the thermal welding of the optical fiber end, in that the ferrule is pressed into a receptacle of the ferrule holder after the thermal welding, in that a basic housing with an axially operating compression spring is arranged over the ferrule holder, in that a crimping ring for fixing the stress member of the optical

fiber is pressed on the basic housing, in that an anti-kink guard is applied over the cladding of the optical fiber to be connected, and over the end of the basic housing, and in that an outer housing with latching elements is drawn on as a cover.

Furthermore, the object arises with the invention of developing a method for connecting the connector according to the invention to the end of an optical fiber. This object set is achieved with the aid of the method according to the features of claim 5.

Owing to the design of the optical fiber connector according to the invention, it is to be emphasized as a particular advantage by comparison with the prior art that splicing the optical fiber piece held in a ferrule onto the end of the optical fiber to be connected can not be executed inside a connector housing, but separately outside thereof. In addition, it is now possible also to make use of a normal optical splicer for the thermal welding of the optical fiber ends. This means that a specially modified splicer that must be tuned to the geometry of the connector housing need not be used, as previously customary, for the splicing. Moreover, the welding takes place outside the ferrule, and so the material of the ferrule is no longer exposed to the high temperatures during the thermal welding operation. After the welding operation, the optical fiber connector is then assembled, the ferrule firstly being pressed into a receptacle in a ferrule holder and thereby fixed exactly in position. Subsequently, the further individual parts of the optical fiber connector, which have previously already been pushed in the appropriate sequence onto the optical fiber to be connected, are positioned over the ferrule and the ferrule holder. This completely eliminates the expensive splicing by welding inside the optical fiber connector, and/or a ferrule specially modified therefor and a splicer also specifically created therefor. The splicing is therefore a routine mounting operation such as is otherwise also carried out in the case of any thermal optical fiber splicing between two optical fiber ends. The design of the optical fiber connector described therefor also simultaneously characterizes the method according to the invention, in accordance with which the optical fiber connector is assembled after the finished thermal welding of the optical fiber ends. It is particularly advantageous in the case of the method that the splicing is performed before the assembly of the optical fiber connector, using the distances and dimensions prescribed by the individual parts. Consequently, all the positions of the individual parts are already prescribed for the assembly at this first operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be explained in more detail with the aid of four figures, in which:

Figure 1 shows the finally mounted optical fiber connector,

Figure 2 shows the optical fiber connector according to figure 1, in a longitudinal section,

Figure 3 shows the basic housing of the optical fiber connector with inserted ferrule, and

Figure 4 illustrates the cycle of the method according to the invention for producing the thermal welding of the optical fiber ends, and for mounting the optical fiber connector.

DESCRIPTION OF THE INVENTION

The optical fiber connector in accordance with the invention is illustrated in the assembled state in Fig. 1. It therefore shows the ferrule 2, which is inserted into a basic housing 11, and in which the optical fiber piece 2a required for splicing is centrally arranged. The end faces 3 of the ferrule 2 and of the optical fiber piece 2a have already been provided at the factory with a suitable section such as, for example, with one of the types of section 0°PC, APC, UPC, which are known per se, such that complicated and difficult work no longer be executed when actually mounting the connector. An outer housing 1, which is provided with the corresponding latching elements 20a for fixing the optical fiber connector, is mounted over the basic housing 11. The anti-kink guard 13 projects at the opposite end of the optical fiber connector. Also indicated is a section II-II, which is explained in figure 2.

Figure 2 shows the entire inner design of the optical fiber connector according to the invention, the optical fiber connector already being finished at the splice point 15. It follows therefrom that the ferrule 2 with the optical fiber piece 2a already inserted at the factory, and with the end face 3, likewise provided with the desired section in the factory, is pressed after splicing has been performed in a receptacle

18 of the ferrule holder 9 after splicing has been perform and thereby fixed. Located inside a bore 9a in the ferrule holder 9 are the ends, connected to one another at the splice point 15, of the optical fiber piece 2a and of the optical fiber 6 to be connected, which is freed from its coating 7 in the welding point region. The stress members 8, for example Kevlar fibers, of the optical fiber cable 14 are fixed at the end of the basic housing 11 with the aid of a crimping ring 12. The basic housing 11 is secured in its position with the ferrule 9 by resilient latching elements 19. A pressure spring 10, which ensures the required contact pressure with the connector inserted, is drawn on a rear step of the basic housing 11. Also illustrated is the anti-kink guard 13, which prevents impermissible kinking of the inserted optical fiber cable 14. It may also be seen that the cladding 17 has been provided during mounting with longitudinal slots 17a.

Illustrated in figure 3 is the basic housing 11 with a latching element 20b which serves for latching into the outer housing, which surrounds it later. Also illustrated is the inserted ferrule 2 with the optical fiber piece 2a and the ground end face 3.

It follows from figure 4 how the individual parts of the optical fiber connector are combined for mounting before the splicing operation, and so the method according to the invention can also be derived from this illustration. Thus, the cladding 17 of the optical fiber cable 14 is provided on a length of approximately 20 mm with longitudinal slots 17a such that the stress members 8 of the optical fiber cable 14 can be gripped. Moreover, the optical fiber cable 14 is freed from its coating in the region of the welding point 15 over a length of approximately 8 mm. The anti-kink guard 13, the crimping ring 12 and the basic housing 11 are now pushed in sequence over the cladding 17 of the optical fiber cable 14. The ferrule holder 9 with the pressure spring 10 mounted at the rear is pushed on under the cladding 17 opened by longitudinal slots 17a, the optical fiber still projecting with its coating 7 over a length of approximately 10 mm. The optical fiber cable 14 to be connected is thereby prepared for splicing over a total length of approximately 38mm with the end of the optical fiber piece 2a projecting in the ferrule 2. The end, prepared with the individual parts, of the optical fiber cable 14 is now laid into a completely normal thermal optical fiber splicer SG, known per se and illustrated here only symbolically, and fixed in its position with clamps E. From the other side of the optical fiber splicer SG, the optical conductor piece 2a already fixed in the ferrule 2 in the factory is pushed in the opposite direction up to the splice point 15 and

likewise fixed with clamps E, the length of the projecting optical fiber piece 2a being approximately 6 mm. The dimensions in this figure are to be regarded only as examples and are, of course, to be adapted as appropriate in each case to the optical fiber connector used. After the thermal splicing has been carried out in the way known per se, the ferrule holder 9 is pushed against the ferrule 2, the latter being pressed into and fixed in a receptacle 18 (see figure 2). The splice point 15, and also the exposed optical fiber ends are thereby accommodated in a protected fashion in the bore of the ferrule holder 9. This design and mounting operation according to the invention renders it possible to make use of a commercially available optical fiber splicer. Subsequently, the remaining individual parts previously pushed on are then arranged over the ferrule holder 9, the stress members 8 of the optical fiber cable 14 additionally being clamped and fixed on the ferrule holder by the crimping ring 12. It is also expedient for the ferrule holder 9 also to be pushed in further a little by approximately 2 to 3 mm below the unslotted cable cladding 17.

These measures according to the invention have rendered it possible for the welding point certainly to be situated inside the optical fiber connector when the optical fiber to be connected is spliced on, without the need to provide special bores or cutouts for the welding operation in the ferrule. This simplifies the ferrule very greatly, since, firstly, there is no need to use high-temperature resistant material and, secondly, a simple sleeve shape is completely sufficient. It is advantageous, in addition, that this method also requires no modification or reconfiguration of optical fiber splicers.

ABSTRACT OF THE DISCLOSURE

The invention relates to an optical-fiber connector that consists of a ferrule (2) with a factory-fixed optical fiber cable element (2a) that can be detachably fixed in a ferrule support (9). The optical-fiber cable element (2a) is thermally spliced to the end (6) of the optical fiber cable (14) to be connected before the ferrule (2) is fixed in the seat (18) of the ferrule support (9).

Subsequent marked up

[Description]

[Optical conductor]Optical-Fiber [c]Connector[,] and [a method for]Method of [c]Connection to the [e]End of an [optical conductor]Optical-Fiber-Cable

The invention relates to an optical [conductor] fiber connector having an optical [conductor]fiber piece fixed in the factory in a ferrule, the end of the optical [conductor]fiber directed outward being provided with a [ground]polished surface, and the end directed inward projecting from the ferrule and being connected by thermal welding to the inserted end of an optical [conductor]fiber to be connected, the ferrule further being fixed in a ferrule holder.

Furthermore, the invention relates to a method for connecting this optical [conductor]fiber connector to the end of an optical [conductor]fiber cable.

BACKGROUND OF THE INVENTION

Two groups of connectors, factory-fitted and field-mounting connectors, are known per se. Very good mechanical and optical properties can be achieved with factory-fitted connectors. It is thereby possible to assemble all types of fibers onto the corresponding connectors. The end faces of the connectors can be provided according to the requirements with all known sections such as, for example, 0°PC, APC or UPC. However, it is disadvantageous in this case that this type of connector must be provided with a piece of glass fiber (pigtail) whose length is mostly between 2.5 and 3 meters. The end of this glass fiber piece is then spliced onto the cable to be connected. However, this produces an additional connection, or splice point, which brings with it an additional loss in the transmission link. This connecting point must then additionally be surrounded by an appropriate mechanical guard.

In the case of "field-mounting connectors", it is advantageous that the cable to be connected can be connected directly to the connector. This eliminates the additional splice, and also the additional mechanical guard. A plurality of systems of field-mounting connectors are known. In the case of a bonded connector, the optical [conductor]fiber is bonded in an appropriate receptacle and the end face is subsequently ground and polished. However, with some types of section this grinding and polishing operation is very difficult, or even cannot be executed at all. In the case of what are termed spliced connectors, a synthesis of factory-fitted and

field-mounting connectors is undertaken. With these connectors, the difficult part of bonding in the optical [conductors]fibers, and the grinding of the end face are already carried out in the factory, and the connection, or splicing on of the optical [conductor]fiber to be connected is then executed on site during the actual field assembly. In principle, this type of connector corresponds to a factory-fitted connector, but no additional outlay is required here to protect the splice point, because the splice is located directly in the connector. Such a type of connector is known by the name of "FuseLite connector". In the case of such a "FuseLite connector", use is made of a factory-fitted ferrule with a bonded optical [conductor]fiber that is ground at the end face and in the case of which an optical [conductor]fiber piece projects [on]toward the second end face. The optical [conductor]fiber to be connected is mounted directly onto this optical [conductor]fiber piece by thermal splicing inside the connector housing. This means that in this region the connector must have appropriate cutouts through which the arc must be guided for welding. This means that in this region the connector must consist of a material of high quality that is exceptionally heat resistant. This material is not permitted to warp at the existing high temperatures, since otherwise it is impossible to achieve the required splice quality. A high quality ceramic, for example zirconium, is used as material for this purpose.

German laid-open application DE 19517750 discloses an optical [conductor]fiber connector in the case of which the end of an already permanently fixed piece of optical [conductor]fiber is connected by thermal welding in a connecting sleeve to the end of an optical conductor to be connected. Recessed into the connecting sleeve for this purpose are lateral openings through which the welding electrodes are led up to the splice point.

SUMMARY OF THE INVENTION

It is the object of the present invention to create a field mounting optical [conductor]fiber connector in the case of which the above-named difficulties relating to splicing are simplified, and in the case of which it is also possible to make use in the splice region of materials not of such high quality. The object set is achieved with the aid of an optical [conductor]fiber connector of the type explained at the beginning, by virtue of the fact that the ferrule with the fixed optical [conductor]fiber can be detached from the ferrule holder before the thermal welding of the optical [conductor]fiber end, in that the ferrule is pressed into a

receptacle of the ferrule holder after the thermal welding, in that a basic housing with an axially operating compression spring is arranged over the ferrule holder, in that a crimping ring for fixing the stress member of the optical [conductor]fiber is pressed on the basic housing, in that an anti-kink guard is applied over the cladding of the optical [conductor]fiber to be connected, and over the end of the basic housing, and in that an outer housing with latching elements is drawn on as a cover.

Furthermore, the object arises with the invention of developing a method for connecting the connector according to the invention to the end of an optical [conductor]fiber. This object set is achieved with the aid of the method according to the features of claim 5.

Owing to the design of the optical [conductor]fiber connector according to the invention, it is to be emphasized as a particular advantage by comparison with the prior art that splicing the optical [conductor]fiber piece held in a ferrule onto the end of the optical [conductor]fiber to be connected can not be executed [not] inside a connector housing, but separately outside thereof. In addition, it is now possible also to make use of a normal optical splicer for the thermal welding of the optical [conductor]fiber ends. This means that a specially modified splicer that must be tuned to the geometry of the connector housing need not be used, as previously customary, for the splicing. Moreover, the welding takes place outside the ferrule, and so the material of the ferrule is no longer exposed to the high temperatures during the thermal welding operation. After the welding operation, the optical [conductor]fiber connector is then assembled, the ferrule firstly being pressed into a receptacle in a ferrule holder and thereby fixed exactly in position. Subsequently, the further individual parts of the optical [conductor]fiber connector, which have previously already been pushed in the appropriate sequence onto the optical [conductor]fiber to be connected, are positioned over the ferrule and the ferrule holder. This completely eliminates the expensive splicing by welding inside the optical [conductor]fiber connector, and/or a ferrule specially modified therefor and a splicer also specifically created therefor. The splicing is therefore a routine mounting operation such as is otherwise also carried out in the case of any thermal optical [conductor]fiber splicing between two optical [conductor]fiber ends. The design of the optical [conductor]fiber connector described therefor also simultaneously characterizes the method according to the invention, in accordance

with which the optical [conductor]fiber connector is assembled after the finished thermal welding of the optical [conductor]fiber ends. It is particularly advantageous in the case of the method that the splicing is performed before the assembly of the optical [conductor]fiber connector, using the distances and dimensions prescribed by the individual parts. Consequently, all the positions of the individual parts are already prescribed for the assembly at this first operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be explained in more detail with the aid of four figures, in which:

[f]Figure 1 shows the finally mounted optical [conductor]fiber connector,

[f]Figure 2 shows the optical [conductor]fiber connector according to figure 1, in a longitudinal section,

[f]Figure 3 shows the basic housing of the optical [conductor]fiber connector with inserted ferrule, and

[f]Figure 4 illustrates the cycle of the method according to the invention for producing the thermal welding of the optical [conductor]fiber ends, and for mounting the optical [conductor]fiber connector.

DESCRIPTION OF THE INVENTION

The optical [conductor]fiber connector in accordance with the invention is illustrated in the assembled state in [figure]Fig. 1. It therefore shows the ferrule 2, which is inserted into a basic housing 11, and in which the optical [conductor]fiber piece 2a required for splicing is centrally arranged. The end faces 3 of the ferrule 2 and of the optical [conductor]fiber piece 2a have already been provided at the factory with a suitable section such as, for example, with one of the types of section 0°PC, APC, UPC, which are known per se, such that [no] complicated and difficult work [need any]no longer be executed when actually mounting the connector. An outer housing 1, which is provided with the corresponding latching elements 20a for fixing the optical [conductor]fiber connector, is mounted over the basic housing 11. The anti-kink guard 13 projects at the opposite end of the optical

[conductor]fiber connector. Also indicated is a section II-II, which is explained in figure 2.

Figure 2 shows the entire inner design of the optical [conductor]fiber connector according to the invention, the optical [conductor]fiber connector already being finished at the splice point 15. It follows therefrom that the ferrule 2 with the optical [conductor]fiber piece 2a already inserted at the factory, and with the end face 3, likewise provided with the desired section in the factory, is pressed after splicing has been performed in a receptacle 18 of the ferrule holder 9 after splicing has been perform and thereby fixed. Located inside a bore 9a in the ferrule holder 9 are the ends, connected to one another at the splice point 15, of the optical [conductor]fiber piece 2a and of the optical [conductor]fiber 6 to be connected, which is freed from its coating 7 in the welding point region. The stress members 8, for example Kevlar fibers, of the optical [conductor]fiber cable 14 are fixed at the end of the basic housing 11 with the aid of a crimping ring 12. The basic housing 11 is secured in its position with the ferrule 9 by resilient latching elements 19. A pressure spring 10, which ensures the required contact pressure with the connector inserted, is drawn on a rear step of the basic housing 11. Also illustrated is the anti-kink guard 13, which prevents impermissible kinking of the inserted optical [conductor]fiber cable 14. It may also be seen that the cladding 17 has been provided during mounting with longitudinal slots 17a.

Illustrated in figure 3 is the basic housing 11 with a latching element 20b which serves for latching into the outer housing, which surrounds it later. Also illustrated is the inserted ferrule 2 with the optical [conductor]fiber piece 2a and the ground end face 3.

It follows from figure 4 how the individual parts of the optical [conductor]fiber connector are combined for mounting before the splicing operation, and so the method according to the invention can also be derived from this illustration. Thus, the cladding 17 of the optical [conductor]fiber cable 14 is provided on a length of approximately 20 mm with longitudinal slots 17a such that the stress members 8 of the optical [conductor]fiber cable 14 can be gripped. Moreover, the optical [conductor]fiber cable 14 is freed from its coating in the region of the welding point 15 over a length of approximately 8 mm. The anti-kink guard 13, the crimping ring 12 and the basic housing 11 are now pushed in sequence over the

cladding 17 of the optical [conductor]fiber cable 14. The ferrule holder 9 with the pressure spring 10 mounted at the rear is pushed on under the cladding 17 opened by longitudinal slots 17a, the optical [conductor]fiber still projecting with its coating 7 over a length of approximately 10 mm. The optical [conductor]fiber cable 14 to be connected is thereby prepared for splicing over a total length of approximately 38mm with the end of the optical [conductor]fiber piece 2a projecting in the ferrule 2. The end, prepared with the individual parts, of the optical [conductor]fiber cable 14 is now laid into a completely normal thermal optical [conductor]fiber splicer SG, known per se and illustrated here only symbolically, and fixed in its position with clamps E. From the other side of the optical [conductor]fiber splicer SG, the optical conductor piece 2a already fixed in the ferrule 2 in the factory is pushed in the opposite direction up to the splice point 15 and likewise fixed with clamps E, the length of the projecting optical [conductor]fiber piece 2a being approximately 6 mm. The dimensions in this figure are to be regarded only as examples and are, of course, to be adapted as appropriate in each case to the optical [conductor]fiber connector used. After the thermal splicing has been carried out in the way known per se, the ferrule holder 9 is pushed against the ferrule 2, the latter being pressed into and fixed in a receptacle 18 (see figure 2). The splice point 15, and also the exposed optical [conductor]fiber ends are thereby accommodated in a protected fashion in the bore of the ferrule holder 9. This design and mounting operation according to the invention renders it possible to make use of a commercially available optical [conductor]fiber splicer. Subsequently, the remaining individual parts previously pushed on are then arranged over the ferrule holder 9, the stress members 8 of the optical [conductor]fiber cable 14 additionally being clamped and fixed on the ferrule holder by the crimping ring 12. It is also expedient for the ferrule holder 9 also to be pushed in further a little by approximately 2 to 3 mm below the unslotted cable cladding 17.

These measures according to the invention have rendered it possible for the welding point certainly to be situated inside the optical [conductor]fiber connector when the optical [conductor]fiber to be connected is spliced on, without the need to provide special bores or cutouts for the welding operation in the ferrule. This simplifies the ferrule very greatly, since, firstly, there is no need to use high-temperature resistant material and, secondly, a simple sleeve shape is completely

sufficient. It is advantageous, in addition, that this method also requires no modification or reconfiguration of optical [conductor]fiber splicers.

ABSTRACT OF THE DISCLOSURE

The invention relates to an optical-fiber connector that consists of a ferrule (2) with a factory-fixed optical fiber cable element (2a) that can be detachably fixed in a ferrule support (9). The optical-fiber cable element (2a) is thermally spliced to the end (6) of the optical fiber cable (14) to be connected before the ferrule (2) is fixed in the seat (18) of the ferrule support (9).

10/031666
WO 01/06291 PCT/DE00/02324
531 Rec'd PCT/PTO 18 JAN 2002

Description

Optical conductor connector, and a method for connection to the end of an optical conductor

The invention relates to an optical conductor connector having an optical conductor piece fixed in the factory in a ferrule, the end of the optical conductor directed outward being provided with a ground surface, and the end directed inward projecting from the ferrule and being connected by thermal welding to the inserted end of an optical conductor to be connected, the ferrule further being fixed in a ferrule holder.

Furthermore, the invention relates to a method for connecting this optical conductor connector to the end of an optical conductor.

Two groups of connectors, factory-fitted and field-mounting connectors, are known per se. Very good mechanical and optical properties can be achieved with factory-fitted connectors. It is thereby possible to assemble all types of fibers onto the corresponding connectors. The end faces of the connectors can be provided according to the requirements with all known sections such as, for example, 0°PC, APC or UPC. However, it is disadvantageous in this case that this type of connector must be provided with a piece of glass fiber (pigtail) whose length is mostly between 2.5 and 3 meters. The end of this glass fiber piece is then spliced onto the cable to be connected. However, this produces an additional connection, or splice point, which brings with it an additional loss in the transmission link. This connecting point must then additionally be surrounded by an appropriate mechanical guard.

In the case of "field-mounting connectors", it is advantageous that the cable to be connected can be

connected directly to the connector. This eliminates the additional splice, and also the additional mechanical guard. A plurality of systems of field-mounting connectors are known. In the case of a bonded connector, the optical conductor is bonded in an appropriate receptacle and the end face is subsequently ground and polished. However, with some types of section this grinding and polishing operation is very difficult, or even cannot be executed at all. In the case of what are termed spliced connectors, a synthesis of factory-fitted and field-mounting connectors is undertaken. With these connectors, the difficult part of bonding in the optical conductors, and the grinding of the end face are already carried out in the factory, and the connection, or splicing on of the optical conductor to be connected is then executed on site during the actual field assembly. In principle, this type of connector corresponds to a factory-fitted connector, but no additional outlay is required here to protect the splice point, because the splice is located directly in the connector. Such a type of connector is known by the name of "FuseLite connector". In the case of such a "FuseLite connector", use is made of a factory-fitted ferrule with a bonded optical conductor that is ground at the end face and in the case of which an optical conductor piece projects on the second end face. The optical conductor to be connected is mounted directly onto this optical conductor piece by thermal splicing inside the connector housing. This means that in this region the connector must have appropriate cutouts through which the arc must be guided for welding. This means that in this region the connector must consist of a material of high quality that is exceptionally heat resistant. This material is not permitted to warp at the existing high temperatures, since otherwise it is impossible to achieve the required splice quality. A high quality ceramic, for example zirconium, is used as material for this purpose.

German laid-open application DE 19517750 discloses an optical conductor connector in the case of which the end of an already permanently fixed piece of optical conductor is connected by thermal welding in a connecting sleeve to the end of an optical conductor to be connected. Recessed into the connecting sleeve for this purpose are lateral openings through which the welding electrodes are led up to the splice point.

It is the object of the present invention to create a field mounting optical conductor connector in the case of which the above-named difficulties relating to splicing are simplified, and in the case of which it is also possible to make use in the splice region of materials not of such high quality. The object set is achieved with the aid of an optical conductor connector of the type explained at the beginning, by virtue of the fact that the ferrule with the fixed optical conductor can be detached from the ferrule holder before the thermal welding of the optical conductor end, in that the ferrule is pressed into a receptacle of the ferrule holder after the thermal welding, in that a basic housing with an axially operating compression spring is arranged over the ferrule holder, in that a crimping ring for fixing the stress member of the optical conductor is pressed on the basic housing, in that an anti-kink guard is applied over the cladding of the optical conductor to be connected, and over the end of the basic housing, and in that an outer housing with latching elements is drawn on as a cover.

Furthermore, the object arises with the invention of developing a method for connecting the connector according to the invention to the end of an optical conductor. This object set is achieved with the aid of the method according to the features of claim 5.

Owing to the design of the optical conductor connector according to the invention, it is to be emphasized as a particular advantage by comparison with the prior art that splicing the optical conductor piece held in a ferrule onto the end of the optical conductor to be connected can be executed not inside a connector housing, but separately outside thereof. In addition, it is now possible also to make use of a normal optical splicer for the thermal welding of the optical conductor ends. This means that a specially modified splicer that must be tuned to the geometry of the connector housing need not be used, as previously customary, for the splicing. Moreover, the welding takes place outside the ferrule, and so the material of the ferrule is no longer exposed to the high temperatures during the thermal welding operation. After the welding operation, the optical conductor connector is then assembled, the ferrule firstly being pressed into a receptacle in a ferrule holder and thereby fixed exactly in position. Subsequently, the further individual parts of the optical conductor connector, which have previously already been pushed in the appropriate sequence onto the optical conductor to be connected, are positioned over the ferrule and the ferrule holder. This completely eliminates the expensive splicing by welding inside the optical conductor connector, and/or a ferrule specially modified therefor and a splicer also specifically created therefor. The splicing is therefore a routine mounting operation such as is otherwise also carried out in the case of any thermal optical conductor splicing between two optical conductor ends. The design of the optical conductor connector described therefor also simultaneously characterizes the method according to the invention, in accordance with which the optical conductor connector is assembled after the finished thermal welding of the optical conductor ends. It is particularly advantageous in the case of the method that the splicing is performed before the assembly of

the optical conductor connector, using the distances and dimensions prescribed by the individual parts. Consequently, all the positions of the individual parts are already prescribed for the assembly at this first operation.

The invention will now be explained in more detail with the aid of four figures, in which:

figure 1 shows the finally mounted optical conductor connector,

figure 2 shows the optical conductor connector according to figure 1, in a longitudinal section,

figure 3 shows the basic housing of the optical conductor connector with inserted ferrule, and

figure 4 illustrates the cycle of the method according to the invention for producing the thermal welding of the optical conductor ends, and for mounting the optical conductor connector.

The optical conductor connector in accordance with the invention is illustrated in the assembled state in figure 1. It therefore shows the ferrule 2, which is inserted into a basic housing 11, and in which the optical conductor piece 2a required for splicing is centrally arranged. The end faces 3 of the ferrule 2 and of the optical conductor piece 2a have already been provided at the factory with a suitable section such as, for example, with one of the types of section 0°PC, APC, UPC, which are known per se, such that no complicated and difficult work need any longer be executed when actually mounting the connector. An outer housing 1, which is provided with the corresponding latching elements 20a for fixing the optical conductor

connector, is mounted over the basic housing 11. The anti-kink guard 13 projects at the opposite end of the optical conductor connector. Also indicated is a section II-II, which is explained in figure 2.

Figure 2 shows the entire inner design of the optical conductor connector according to the invention, the optical conductor connector already being finished at the splice point 15. It follows therefrom that the ferrule 2 with the optical conductor piece 2a already inserted at the factory, and with the end face 3, likewise provided with the desired section in the factory, is pressed after splicing has been performed in a receptacle 18 of the ferrule holder 9 and thereby fixed. Located inside a bore 9a in the ferrule holder 9 are the ends, connected to one another at the splice point 15, of the optical conductor piece 2a and of the optical conductor 6 to be connected, which is freed from its coating 7 in the welding point region. The stress members 8, for example Kevlar fibers, of the optical conductor 14 are fixed at the end of the basic housing 11 with the aid of a crimping ring 12. The basic housing 11 is secured in its position with the ferrule 9 by resilient latching elements 19. A pressure spring 10, which ensures the required contact pressure with the connector inserted, is drawn on a rear step of the basic housing 11. Also illustrated is the anti-kink guard 13, which prevents impermissible kinking of the inserted optical conductor 14. It may also be seen that the cladding 17 has been provided during mounting with longitudinal slots 17a.

Illustrated in figure 3 is the basic housing 11 with a latching element 20b which serves for latching into the outer housing, which surrounds it later. Also illustrated is the inserted ferrule 2 with the optical conductor piece 2a and the ground end face 3.

It follows from figure 4 how the individual parts of the optical conductor connector are combined for mounting before the splicing operation, and so the method according to the invention can also be derived from this illustration. Thus, the cladding 17 of the optical conductor cable 14 is provided on a length of approximately 20 mm with longitudinal slots 17a such that the stress members 8 of the optical conductor 14 can be gripped. Moreover, the optical conductor 14 is freed from its coating in the region of the welding point 15 over a length of approximately 8 mm. The anti-kink guard 13, the crimping ring 12 and the basic housing 11 are now pushed in sequence over the cladding 17 of the optical conductor 14. The ferrule holder 9 with the pressure spring 10 mounted at the rear is pushed on under the cladding 17 opened by longitudinal slots 17a, the optical conductor still projecting with its coating 7 over a length of approximately 10 mm. The optical conductor 14 to be connected is thereby prepared for splicing over a total length of approximately 38mm with the end of the optical conductor piece 2a projecting in the ferrule 2. The end, prepared with the individual parts, of the optical conductor 14 is now laid into a completely normal thermal optical conductor splicer SG, known per se and illustrated here only symbolically, and fixed in its position with clamps E. From the other side of the optical conductor splicer SG, the optical conductor piece 2a already fixed in the ferrule 2 in the factory is pushed in the opposite direction up to the splice point 15 and likewise fixed with clamps E, the length of the projecting optical conductor piece 2a being approximately 6 mm. The dimensions in this figure are to be regarded only as examples and are, of course, to be adapted as appropriate in each case to the optical conductor connector used. After the thermal splicing has been carried out in the way known per se, the ferrule holder 9 is pushed against the ferrule 2, the latter being pressed into and fixed in a receptacle 18

(see figure 2). The splice point 15, and also the exposed optical conductor ends are thereby accommodated in a protected fashion in the bore of the ferrule holder 9. This design and mounting operation according to the invention renders it possible to make use of a commercially available optical conductor splicer. Subsequently, the remaining individual parts previously pushed on are then arranged over the ferrule holder 9, the stress members 8 of the optical conductor 14 additionally being clamped and fixed on the ferrule holder by the crimping ring 12. It is also expedient for the ferrule holder 9 also to be pushed in further a little by approximately 2 to 3 mm below the unslotted cable cladding 17.

These measures according to the invention have rendered it possible for the welding point certainly to be situated inside the optical conductor connector when the optical conductor to be connected is spliced on, without the need to provide special bores or cutouts for the welding operation in the ferrule. This simplifies the ferrule very greatly, since, firstly, there is no need to use high-temperature resistant material and, secondly, a simple sleeve shape is completely sufficient. It is advantageous, in addition, that this method also requires no modification or reconfiguration of optical conductor splicers.

Patent claims

1. An optical conductor connector having an optical conductor piece fixed in the factory in a ferrule, the end of the optical conductor piece directed outward being provided with a ground surface, and the end of the optical conductor piece directed inward projecting from the ferrule and being connected by thermal welding to the inserted end of an optical conductor to be connected, the ferrule further being fixed in a ferrule holder, characterized in that the ferrule (2) with the fixed optical conductor piece (2a) can be detached from the ferrule holder (9) before the thermal welding of the optical conductor ends, in that the ferrule (2) is pressed into a receptacle (18) of the ferrule holder (9) after the thermal welding, in that a basic housing (11) with an axially operating compression spring (10) is arranged over the ferrule holder (9), in that a crimping ring (12) for fixing the stress member (8) of the optical conductor (14) is pressed on the basic housing (11), in that an anti-kink guard (13) is applied over the cladding (17) of the optical conductor (14) to be connected, and over the end of the basic housing (11), and in that an outer housing (1) with latching elements (20a) is drawn on as a cover.

2. The optical conductor connector as claimed in claim 1, characterized in that the basic housing (11) is fixed on the ferrule holder (9) with the aid of latching elements (19).

3. The optical conductor connector as claimed in one of the preceding claims, characterized in that the ends of the optical conductor piece (2a) and of the optical conductor (6) to be connected are guided in a protected fashion with the welding

point (15) lying therebetween inside the longitudinal bore (9a) of the ferrule (9).

4. The optical conductor connector as claimed in one of the preceding claims, characterized in that the outer housing (1) is provided with latching elements (20a) which act correspondingly with those of connector receptacles.

5. A method for connecting the optical conductor connector as claimed in one of the preceding claims to the end of an optical conductor to be connected, characterized in that firstly the anti-kink guard (13), the crimping ring (12) and the basic housing (11) are pushed onto the cladding (17) of the optical conductor (14) to be connected, in that the cladding (17) of the optical conductor (14) is slotted by at least one longitudinal slot (17a) to the length required for the optical conductor connector, in that the end (6) of the optical conductor (14) is freed from the coating (7) to the length required for the splicing, in that the ferrule holder (9) with the compression spring (10) mounted on the end is pushed onto the optical conductor (14), in that the end of the optical conductor piece (2a) projecting from the ferrule (2), and the end (6) of the optical conductor (14) to be connected are connected to one another in a thermal optical conductor splicer (SG) known per se, in that thereafter the ferrule (2) is pressed into the end-face receptacle (18) of the ferrule holder (9), in that the basic housing (11) is pushed thereover and fixed, in that the crimping ring (12) is pressed on over the stress member (8) of the optical conductor (14), in that the anti-kink guard (13) is fixed on the basic housing (11), and in that the outer housing (1) is drawn on over the mounted connector unit.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
25. Januar 2001 (25.01.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/06291 A1

(51) Internationale Patentklassifikation[7]: G02B 6/38

(21) Internationales Aktenzeichen: PCT/DE00/02324

(22) Internationales Anmeldedatum:
18. Juli 2000 (18.07.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 33 740.3 19. Juli 1999 (19.07.1999) DE

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(81) Bestimmungsstaaten *(national)*: AU, CA, US.

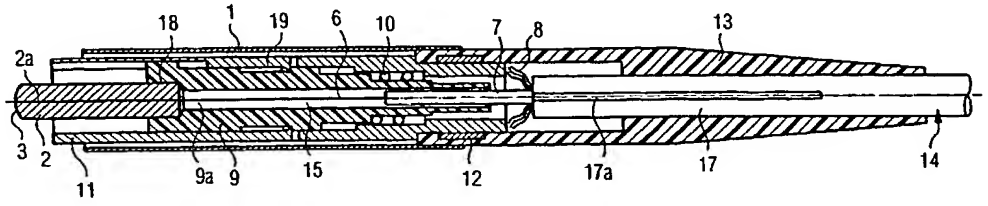
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht:
— *Mit internationalem Recherchenbericht.*
— *Vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen.*

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) Title: OPTICAL-FIBER CONNECTOR AND METHOD OF CONNECTION TO THE END OF AN OPTICAL-FIBER CABLE

(54) Bezeichnung: LICHTWELLENLEITERSTECKER UND VERFAHREN ZUM ANSCHLUSS AN DAS ENDE EINES LICHTWELLENLEITERS



(57) Abstract: The invention relates to an optical-fiber connector that consists of a ferrule (2) with a factory-fixed optical-fiber cable element (2a) that can be detachably fixed in a ferrule support (9). The optical-fiber cable element (2a) is thermally spliced to the end (6) of the optical fiber cable (14) to be connected before the ferrule (2) is fixed in the seat (18) of the ferrule support (9).

(57) Zusammenfassung: Bei der Erfindung handelt es sich um einen Lichtwellenleiterstecker aus einer Ferrule (2) mit werkseitig fixiertem Lichtwellenleiterstück (2a), die trennbar in einem Ferrulenhalter (9) fixierbar ist. Die thermische Anspleißung des Lichtwellenleiterstücks (2a) mit dem Ende (6) eines anzuschließenden Lichtwellenleiters (14) erfolgt vor dem Fixieren der Ferrule (2) in der Aufnahme (18) des Ferrulen-Halters (9).

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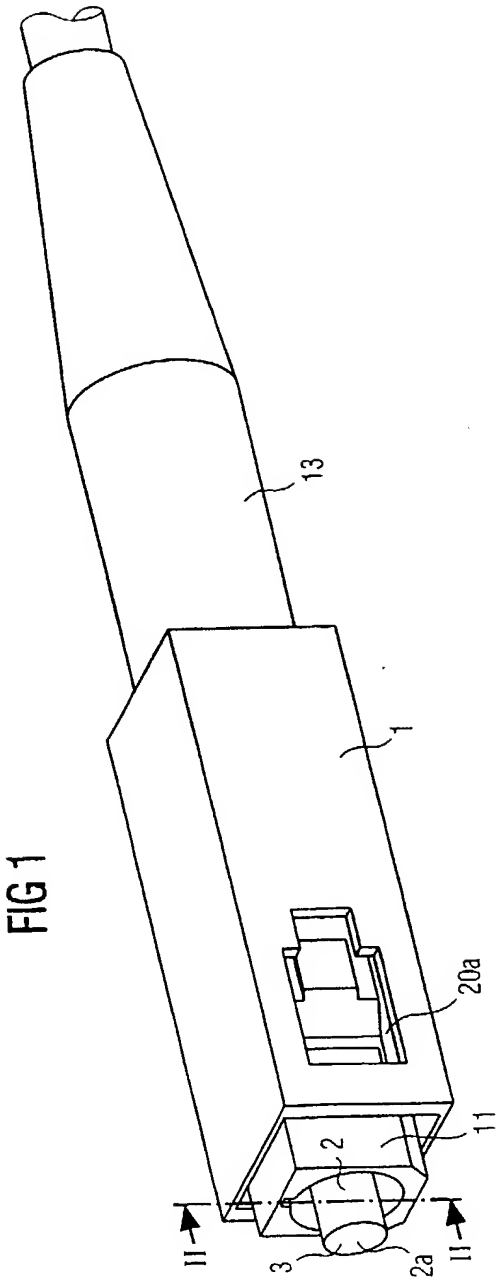


FIG 1

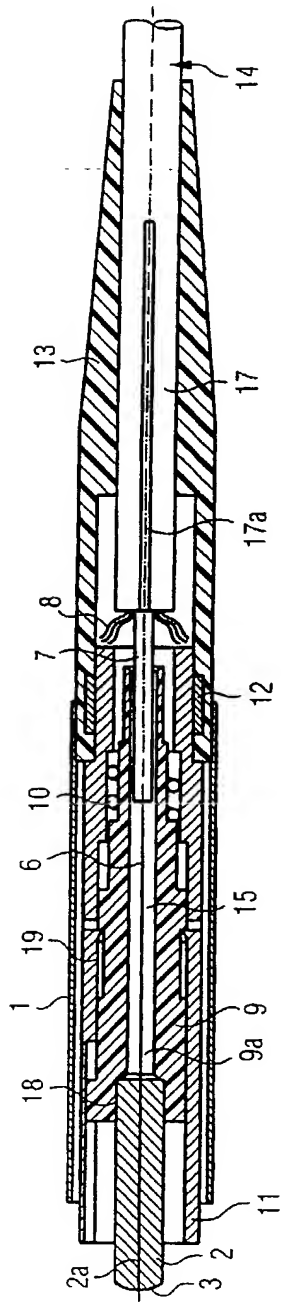


FIG 2

FIG 3

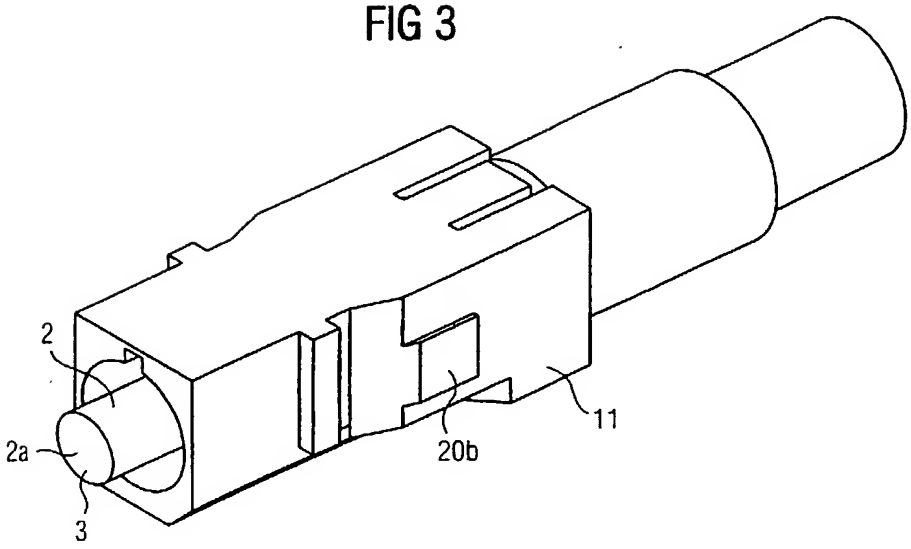
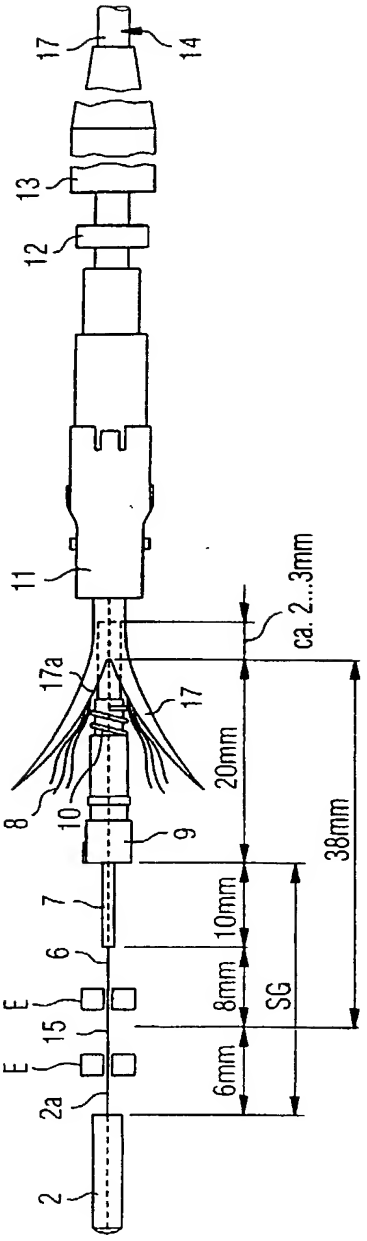


FIG 4



PTO/SB/103 (8-96)
Approved for use through 9/30/98 OMB 0651-0032
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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Optical-Fiber Connector and Method of Connection to the End of an Optical-Fiber-Cable

the specification of which is attached hereto unless the following box is checked:

☒ was filed on 1/18/02 as United States Application Number or PCT International Application Number 10/031,666 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Prior Foreign Applications
(Frühere ausländische Anmeldungen)

(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	Priority Not Claimed Priorität nicht beansprucht
19933740.3	Germany	19/07/99	☐
			☐

Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, § 119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

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(Application No.) (Aktenzeichen)	(Filing Date) (Anmeldetag)

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: *(list name and registration number)*

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Vor- und Zuname des zweiten Miterfinders (falls zutreffend)	Full name of second joint inventor, if any Bernd Lipka
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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: *(list name and registration number)*

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Unterschrift des zweiten Erfinders Datum	Second Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

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